



Liquid Nitrogen Free EX-Calibur Measures Low Levels of Heavy Metals in Plastics and Polymers

Jordan Valley AR, Inc.

New guidelines that determine the amount of cadmium, lead, mercury, and chromium in plastics and polymers are being adopted by countries all over the world. These directives will significantly impact many industries, particularly automotive; electrical and electronic; cable; computer; and recycling. In response to these mandates, Jordan Valley has developed the new EX-Calibur, a liquid nitrogen free Energy Dispersive X-Ray Fluorescence (EDXRF) spectrometer system for the analysis of heavy metals in plastics and polymers.

Existing handheld and benchtop analytical devices that cannot measure these metals at the new levels are a poor investment when compared to analytical instruments that will meet future requirements. The goal of this paper was to develop an analytical method to certify that a plastic part contains less than 5 ppm cadmium, lead, mercury and chromium.

EDXRF is an excellent technique for analyzing plastics since it can monitor stabilizers, colorants and other additives. Additionally, EDXRF instruments provide fast, simple, affordable, on-site analysis with little sample preparation.

The Jordan Valley EX-Calibur represents the cutting edge in EDXRF systems. The powerful analyzer includes a fully-integrated computer system in a compact package that fits conveniently on a laboratory bench.

The EX-Calibur achieves a similar resolution to traditional liquid nitrogen cooled detector units, while eliminating the cost and inconvenience associated with liquid nitrogen. The enhanced design of the EX-Calibur's detector allows superior x-ray flux, as well as the ability to handle higher count rates and complete multi-element analysis while providing optimum sensitivity for low- and high-Z elements.

Experimental Conditions

Measurements were performed using a Jordan Valley EX-Calibur configured with a 50 kV, 50 watt rhodium anode X-Ray tube, equipped with a high-resolution Peltier-cooled PIN Diode detector.

A precision run was performed on a sample to demonstrate the repeatability of the measurement. The average concentration and standard deviation is 5.56 ± 0.70 ppm. The repeatability of the measurement is <1%RSD.

The spectra shows a plastic sample with 25 ppm cadmium

overlapping a sample with no cadmium. Even a 25 ppm sample produces a prominent peak.

Conclusion

The EX-Calibur is the ultimate tool for measuring cadmium, lead, mercury and chromium in plastics and polymers using the 50 kV, 50 watt X-ray tube and careful selection of an optimal filter. The detection limit is 0.5 ppm for cadmium, 2 ppm for lead, 2 ppm for mercury and 1.6 ppm for chromium. Because of the superior performance level, it is possible to make measurements at 100 ppm with < 1% RSD precision with the Ex-Calibur.

The EX-Calibur's high precision allows the QA department to certify that plastic products are comfortably below the 100 ppm level as stipulated by regulations. The EX-Calibur will minimize unnecessary waste now and easily meet the upcoming regulatory requirements when they take effect.

Element: Cd	RMS Deviation: 0.57 PPM	
Unit: Cd (PPM)	R2 Correlation: 0.998	
Sample	Given	Measured
0	0.00	-0.54
5	5.00	4.95
10	10.00	11.18
15	15.00	14.87
20	20.00	20.02
25	25.00	24.52

Table I. Correlation for cadmium in plastic

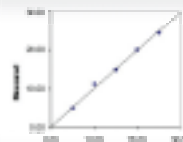


Figure 1. Correlation fit for Cd (ppm)

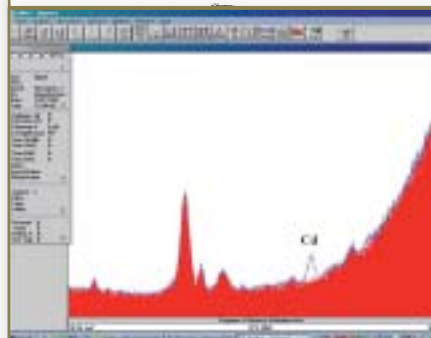


Figure 2. Sensitivity for cadmium in plastic.

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